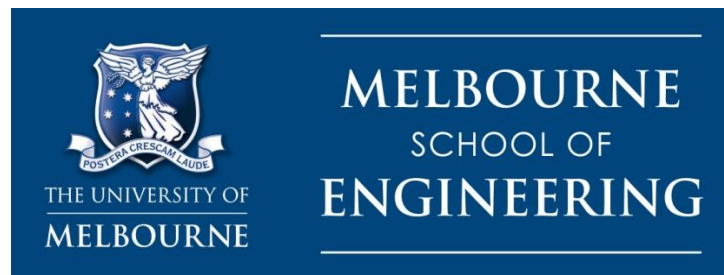




**Centre for
Spatial Data Infrastructures and Land Administration**

2011–2012 Report

Department of Infrastructure Engineering



Content

1	Executive Summary	3
2	History and Background of the Centre.....	5
3	Activities of the Centre	6
4	Centre Management	7
5	Advisory Board in 2011–2012.....	8
6	Research Team	9
7	Research Program.....	14
8	Visiting Program and other official visitors	18
9	Contribution to seminars, conferences and meetings	19
10	Contribution to Professional and Scientific Associations and Societies	20
11	Highlights of the Centre 2011	21
12	Publications in 2011-2012.....	22
13	Website	25

1 Executive Summary

The Centre for Spatial Data Infrastructures and Land Administration (Centre) continues to be highly active and engaged. This report covers the activities and achievements of the Centre over this period from 2011 to the end of August 2012. The Centre has now celebrated its 10th year of activities since it was established by The University of Melbourne in November 2001. The 10th year anniversary was marked by the organisation of the 4th United Nations Land Administration Forum for Asia and the Pacific, where the team held its ten year anniversary celebrations. The Centre organised a world-class Forum, attended by 110 participants from different countries around the world, including representatives from the United Nations, the World Bank, Europe and a number of major international related spatial organisations.

The recent changes in the School of Engineering resulted in a merger between the Department of Geomatics with the Department of Civil Engineering and Environmental Hydrology to form a multi-disciplinary Department of Infrastructure Engineering. And as the new Head of Department of Infrastructure Engineering, I have been involved in high level strategic planning with both the School of Engineering and the wider university community, which impacts the Centre's future directions and strategic plans. In the next few years, we plan to expand the Centre's research potential to include multi-disciplinary units, including research in water and structural engineering. This would result in the Centre potentially taking on a new role, as the research arm for the whole Department of Infrastructure Engineering.

The research undertaken in the Centre mainly uses the States of Victoria, NSW and WA as working laboratories to obtain research data, and to test solutions and outcomes. International linkages through European and North American universities and the UN supported Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) and Global SDI Association (GSDI) give the Centre a strong international foundation to build upon.

The Centre has been and remains at the forefront in the development of spatial enablement, SDI and land administration systems that facilitate decision making within the context of sustainable development objectives at local, state, national and multinational levels. An important role of the Centre is the ability to undertake research within dynamic information and communication technologies and other emerging technology environments that are now playing a much broader role in a modern society in support of the spatial enablement of society. The strong work undertaken within the Centre since its inception, and the linkages created with both national and international organisations and universities, has helped to position the Centre at the forefront of spatial enablement, SDI and land administration research internationally. For the Centre, 2011 and 2012 continues to be a successful year as summarised below:

- 42 Publications in 2011–2012 (books, book chapters, journal and conference papers and technical reports)
- Progress with four ARC projects (Spatial Metadata Automation, NIMLI, 3D Cadstre, Talking about place)
- Contribution to professional and scientific associations and societies
- Centre's website received visits from more than 100 countries located in the Americas, Europe, Africa, Asia and the Pacific and Australia.

There were 31 personnel directly involved with the research in the Centre in 2011–2012.

The Centre also draws on the expertise and joint supervision of academic staff in the Department of Infrastructure Engineering. In 2011, Dr Tuan Ngo, from a Civil Engineering discipline, joined the Centre increasing the expertise and dimension of the sustainable infrastructure research activities of the Centre.

The Visiting Program has been a successful component of the Centre. In 2011–2012, the Centre hosted 4 visits from international researchers and scholars of mutual benefit to the Centre and its research partners.

The success of the Centre is fully dependent on its personnel. Consequently, I wish to acknowledge the contribution of the graduate students and researchers and in particular Professor Ian Williamson; Ms Jude Wallace, Senior Research Fellow; Research Fellows Dr Mohsen Kalantari (lecturing since March 2012) and Dr Ida Jazayeri; and the Research Group's assistant Ms Pauline Woolcock and Ms Rose Macey. It must be remembered that without the support and commitment of our industry

partners, the Federal and State (in particular, the VIC, NSW and WA) Governments, the Centre would not have been able to achieve what it has over the past year. This support and assistance is gratefully acknowledged.

Finally, much of the success of the Centre can be attributed to the work and counselling of the Advisory Committee and the School of Engineering. On behalf of the research team, I wish to acknowledge the strong support provided by the Committee, all our industry partners and the University of Melbourne.

Professor Abbas Rajabifard

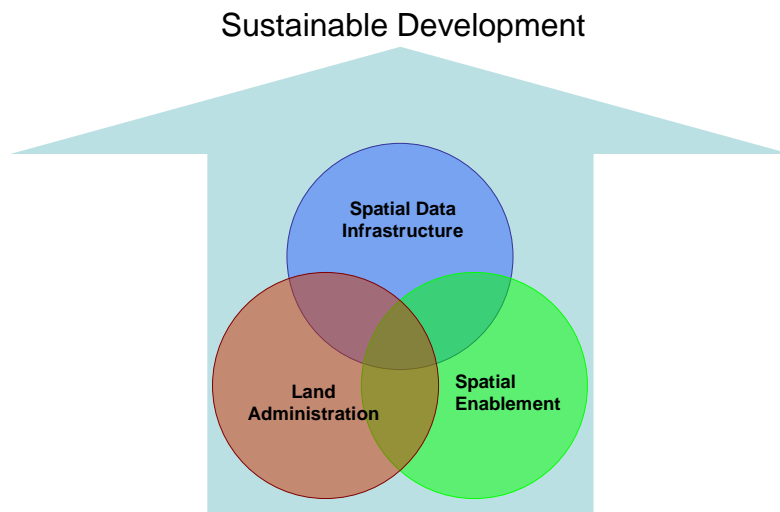
Director

2 History and Background of the Centre

The Centre was formed in 2001 at the University of Melbourne to address an increase of interest in spatial data and land administration infrastructures at State and Federal levels in Australia and internationally. At present, the Centre is the largest and active research team within the Department of Infrastructure Engineering, and has been undertaking research in Land Administration, Spatial Data Infrastructures (SDIs) and spatial enablement, in general, for over a decade.

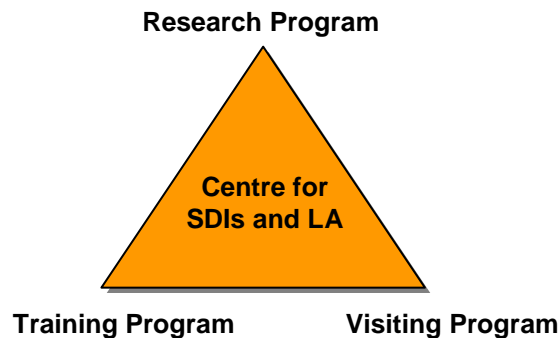
The Centre was built on an already successful research group involving 15 researchers and strong linkages established with the state governments of Victoria and New South Wales, the Federal Government, the United Nations, the World Bank and several universities and foreign governments.

The research group at the Centre provide a focus for research in SDI, Land Administration and Spatial Enablement by building on ongoing research relationships and creating new links through extended collaboration both nationally and internationally.



3 Activities of the Centre

The research activities of the Centre are based on a three-pillared approach through the development of a Research Program, focused and tailored Postgraduate Training Program, and facilitated knowledge transfer including a Visiting Program.



3.1 Objectives of the Research Program:

- To establish a leading group of world-class research scholars in Spatial Data Infrastructures, Land Administration and Spatially Enabled Government and Societies
- To encourage collaborative research projects with state and federal governments in Australia, the private sector and leading overseas universities
- To secure national competitive grants through the development of multi-disciplinary team-based research expertise.
- To secure state, federal and international research grants building on existing well-established collaboration
- To disseminate research findings through academic publications, seminars, conferences and scholarly interchange.

3.2 Objectives of the Training Program:

- To provide a focus for postgraduate students wishing to study and conduct research in the areas of Spatial Data Infrastructures, Land Administration and Spatially Enabled Government Societies (SEG/SES)
- To provide specialised supervisory expertise in Spatial Data Infrastructures and Land Administration and Spatial Enablement
- To develop and enhance the knowledge base and research capabilities in Spatial Data Infrastructures, Land Administration and Spatially Enabled Societies through research training and specific initiatives such as workshops, symposia and conferences
- To conduct short training programs in the fields of Spatial Data Infrastructures, Land Administration and Spatially Enabled Societies for government agencies (both Australian and international), private sector bodies and other interested groups.

3.3 Objectives of the Visiting Program:

- To facilitate research and teaching interchanges among Australian and international scholars working in Spatial Data Infrastructures, Land Administration and Spatially Enabled Societies through Visitor exchange and Seminar programs
- To increase opportunities involving international visitors in specific initiatives such as workshops, seminars and conferences
- To facilitate collaborative links between institutions and visitors regarding research and postgraduate training.

4 Centre Management

Research in the Centre is conducted by staff members of The University of Melbourne, research fellows and students associated with the Centre, and international academic visitors and collaborators.

Professor Abbas Rajabifard directs the Centre.

Professor Abbas Rajabifard

Director

Research Area:

Planning and Management of Spatial Data Strategy and Framework, Disaster Management and Public Safety, Design and Implementation of SDIs, SDI and Spatially Enabled Government and Societies, SDI and Land Administration Platform, Concepts of Virtual Australia.



Professor Ian Williamson on a part-time basis contributes to research and professional activities in support of the Centre's objectives.

Professor Ian Williamson AM, FTSE

Professor of Surveying and Land Information

Research Area:

Cadastral, Land and Geographic Information Systems, Land Administration and SDI.



5 Advisory Board in 2011–2012

The Centre Advisory Board comprises distinguished leaders in spatial science and technologies from academia and industry. Meetings, reports and information dissemination ensure that the Advisory Board members are informed of the research achievements and directions. Advisory Board members also encourage the promotion of networking linkages and research opportunities between the Centre researchers and their own institutions and contact networks.



Hon. Mr Gary Nairn (Chair)	Chairman, VEKTA Pty Ltd, and Consultant in Business Development, Spatial Information and Property Matters
Mr Greg Scott	Group Leader, National Mapping and Information Group, Geoscience Australia and PCGIAP WG3 chair
Mr Ollie Hedberg	Chair Victorian Spatial Council and Chair Public Sector Mapping Agency (PSMA), Australia
Mr Paul Harcombe	Chief Surveyor, Land & Property Management Authority New South Wales
Mr John Tulloch	Surveyor General Victoria, Land Victoria, DSE
Mr Ged Griffin	Detective Inspector, Crime Development, Victoria Police
Mr Jan Wandek	Managing Director, AusSoft Solutions, Pty Ltd.
Professor Harlan Onsrud	Department of Spatial Information Science and Engineering, University of Maine, Executive Director of GSDI Association
Professor Stig Enemark	FIG President, Professor in Land Management- Aalborg University, Denmark
Professor David Coleman	Dean, Faculty of Engineering, University of New Brunswick, Canada
Professor Abbas Rajabifard	Representative from the Centre
Professor Ian Williamson	Representative from the Centre
Dr Mohsen Kalantari	Secretary

6 Research Team

The Centre has 28 active members including research fellows, research associates, PhD and Master students and administrative officers:

<p>Dr Mohsen Kalantari Research Fellow/Lecturer Research Area: Metadata Automation, eLand Administration, 3D Cadastral Data Modelling</p>	
<p>Ms Jude Wallace Senior Research Fellow Research Area: Land Policy, Land Markets and Infrastructure for Land Management, Spatially Enabled Government concept and Positioning Applications</p>	
<p>Mr Brian Marwick Senior Researcher Research Area: Building A National Infrastructure To Manage Land Information In Australia</p>	
<p>Dr Allison Kelly Senior Lecturer Research Area: GPS, GLONASS, Integrated Systems, Navigation</p>	
<p>Dr Joseph Leach Lecturer Research Area: Satellite and airborne remote sensing, digital image processing, environmental assessment</p>	
<p>Dr Ida Jazayeri Research Fellow Research Area: Land and Property Information in 3D, 3D data capture, 3D modelling, Smart Cities, Intelligent Sensor Systems</p>	

Dr Serryn Eagleson

Research Fellow

Research Area: Spatially Enabling Property Management and Editor-GSDI Asia-Pacific Newsletter



Dr Malcolm Park

Research Associate

Research Area: Land Administration and Editor, GSDI Asia-Pacific Newsletter



Dr Joep Cromptvoets

Honorary Research Fellow, Leuven University, Belgium

Research Area: SDI in public administration



Mr Heri Sutanta

PhD Candidate

Research Topic: Spatial Planning Support System for Local Planning and Disaster Management



Mr Hamed Olfat

PhD Candidate

Research Topic: Metadata Generation and Updating Program, GIS, SDI, Urban and Regional planning



Mr Ali Aien

PhD Candidate

Research Topic: 3D Cadastral Data Modelling



Ms Nilofer Tambuwala

PhD Candidate

Research Topic: Building National Infrastructure for Managing Land Markets



Ms Katie Potts

PhD Candidate

Research Topic: Engineering Land and Property Risk Management through Spatial Enablement



Mr Agunbiade Muyiwa

PhD Candidate

Research Topic: Land Administration for Housing Production



Mr Peter Branca (2011)

PhD Candidate

Research Topic: Knowledge-based policing, Spatially enabled Law-Enforcement



Mr Davood Shojaei

PhD Candidate

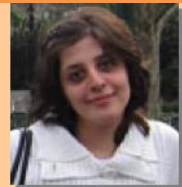
Research Topic: Visualisation platform for 3D Cadastre



Ms Maryam Saydi

PhD Candidate

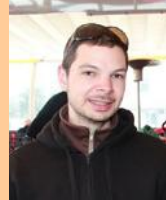
Research Topic: An integrated Spatial Model on a Visual Platform to assess Urban Sustainability



Mr Hervé Senot (2011)

Spatial Information Specialist

Research Topic: Metadata, Open Source, GIS



Mr Sam Amirebrahimi

PhD Candidate

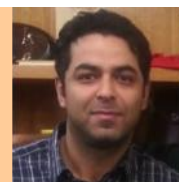
Research Topic: Building Information Modelling, CAD/BIM/GIS Integration, Spatially Enabled Societies, Disaster/Risk Management, 3D Geospatial modelling and Visualisation.



Mr Farhad Laylavi

PhD Candidate

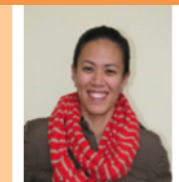
Research Topic: Crowd-sourcing and Volunteered Geographic Information (VGI), Geospatial Technologies for Disaster Management and Public Safety



Ms Serene Ho

PhD Candidate

Research Topic: Facilitating Policy, Legal and Institutional Aspects of Cadastral Systems in the Third Dimension



Mr Paul Box

Masters student

Research Topic: SDI Governance of multi-domain, and cross-jurisdictional SDIs built using Service Oriented Architecture (SOA) Approaches



Mr Amir Nasr

Software Engineer Geospatial Databases

Project: AURIN & ANDS, Metadata



Ms Azadeh Keshtiarast

Data Integration Specialist

Project: AURIN & ANDS



Mr David Roth

Data Integration Support

Project: AURIN & ANDS

Mr Adam Williams

Project Coordinator

Project: AURIN & ANDS

Ms Felicity Clissold (2012)
Communications Manager



Other Affiliated Research Associates:

Final Year Students: Isabel Pacheco and Aastha Sharma

Masters Subject–Project Investigators: Nick Tumney and Sally Jiyeong Lee

7 Research Program

The Centre undertakes research in different areas such as the fundamental principles and applications of land administration, SDIs and spatial enablement. The research projects are usually funded through competitive national research grants such as ARC linkage, discovery funds and consultatory projects. The Centre also provides supervision to PhD and Master Students that are funded through Melbourne University scholarships or other funding schemes.

This section of the report provides an overview of current and submitted ARC funded projects:

7.1 Automating and Integrating Spatial Data and Metadata Process (ARC - Linkage Project) 2009–2012

Staff: Abbas Rajabifard, Ian Williamson, Mohsen Kalantari

Student: Hamed Olfat

Industry partners: ARC, DPI, DSE, LPMA, Aussoft, Cubwerx, Logica

Status: Completed



Spatial metadata automation

The ability to find and access appropriate information relies on having up-to-date metadata. However, current metadata models and standards are complex and very difficult to handle, often with missing or incomplete metadata. It is also viewed as an overhead and extra cost by organisations. The ability to automatically generate metadata relating to spatial information, and making it available through the Australian SDI, will have important benefits not only at an organisational level (with each organisation saving time and money in generating their metadata), but at a national level because it will assist delivery of high quality spatial information and services to vast areas of Australia. This project investigates the importance of having an integrated system for both spatial data and metadata information in which that metadata and spatial data can be integrated within the one spatial dataset, so that when spatial data is updated, metadata related to that data is also automatically updated.

Publications

A total of 8 publications have arisen from this project and 3 between 2011–2012.

Olfat, H., Kalantari, M., Rajabifard, A., Williamson, I. P. and Senot, H. 2012. Spatial Metadata Automation: A Key to Spatially Enabling Platform. *International Journal of Spatial Data Infrastructures Research*, 7, 173-195.

Olfat, H., Kalantari, M., Rajabifard, A., Senot, H. and Williamson, I. P. 2012. A GML-based Approach to Automate Spatial Metadata Updating. *International Journal of GIS*, DOI:10.1080/13658816.2012.678853.

Olfat, H., Kalantari, M., Rajabifard, A. and Williamson, I. 2012. Towards a Foundation for Spatial Metadata Automation. *Journal of Spatial Science*, 57(1), 65-81.

Applications/systems Developed

- User Interface add-on developed for the Open Source Geonetwork System
- Metadata Enrichment prototype system – built in to the Model Information Knowledge Environment
- Metadata Automation GML Application Schema

7.2 A National Infrastructure for Managing Land Information (ARC - Linkage) 2009–2012

Staff: Abbas Rajabifard, Ian Williamson, Jude Wallace, Rohan Bennett

Students: Nilofer Tambuwala, Katie Potts, Brian Marwick, Muyiwa Agunbiade,

Industry partners: LPMA (NSW), Land Victoria, Landgate (WA), PSMA Australia Ltd

Status: In progress



Australia is one of about 30 countries in the world capable of managing land transactions in reliable land registers. The administrative framework, however, is 150 years old, built according to a 19th century statutory model appropriate to a less complicated and slower land market. A new, national administration infrastructure using spatial technologies will update the institutions, while maintaining core processes that support successful land markets.

Spatial technologies are transformational when they are used to improve business processes of government, and assist delivery of policies for conservation of natural resources and planning for rational growth. In this environment, new commodities (water titles, carbon credits, ecoTenders, mortgage-based securities and market-based instruments) are already being designed and used. Restrictions and regulation of land uses and transactions are piecemeal and lack transparency. Community, government and private sectors increasingly need coherent, timely and national land information. Land information, and particularly the digital land parcel map, is Australia's most valuable but underutilised asset.

This project is translating popular spatial technologies into national business tools to better manage land information for the government, community and private sectors. The project is enabling the transformational capacity of spatial enablement, particularly using land information, to improve the way governments make their policies and perform their tasks. Spatial enablement will help to develop decision-making capacity, exposing cross-jurisdictional and inter-agency solutions to national level problems in land and resource management.

The research is focusing on the identifying tools as part of an infrastructure that will build on state land administration systems to improve national trading in commodities including interests in land. The project will test the infrastructure against commodities such as water, mining, carbon and land; however, the focus will be on designing the infrastructure, not solving the many issues surrounding the management of these commodities.

Publications

A total number of 20 publications have arisen from this project and 18 between 2011–2012.

- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J. 2013. On recognizing land administration as critical, public good infrastructure. *Land use policy*. Vol. 30 (1), pp. 84-93
- Bennett, R., Rajabifard, A., Williamson, I. and Wallace, J., 2012. Nations Need National Land Administration Infrastructures. *FIG Working Week 2012*, Rome, Italy: Knowing how to manage the territory, protect the environment, evaluate the cultural heritage.
- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J., 2012. Contemporary Land Administration: The Importance of Being Infrastructure. *FIG Working Week 2012*, 2012 Rome, Italy: Knowing to manage the territory, protect the environment, evaluate the cultural heritage.
- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J. 2012. On recognizing administration as critical, public good infrastructure. *Land use policy*, 30(1), 84-93.
- Marwick, B., Rajabifard, A., Williamson, I. and Kalantari, M., 2012. National Land Information Infrastructure through a Collaborative Framework. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy: Knowing to manage the territory, protect the environment, evaluate the cultural heritage.
- Potts, K., Rajabifard, A., Bennett, R. and Williamson, I., 2012. Spatially Enabled Risk Management: Models, Cases, Validation. In: Coleman, D. and Rajabifard, A. eds. *Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*. GSDI Association.
- Rajabifard, A., Kalantari, M. and Williamson, I., 2012. Land and Property Information in 3D. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy: Knowing how to manage the territory, protect the environment, evaluate the cultural heritage.
- Tambuwala, N., Rajabifard, A., Bennett, R., Wallace, J. and Williamson, I., 2012. Authoritative land information and Australian property markets. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy.
- Tambuwala, N., Rajabifard, A., Bennett, R., Wallace, J. and Williamson, I. 2012. Inter-governmental land information asymmetries in Australia. *Journal of Spatial Sciences*, 57(1), 83-100.
- Agunbiade, M., Rajabifard, A. and Bennett, R., Land Administration for Housing Production: Drivers, Concepts, and Analytical Tools. *FIG Working Week 2011*, 2011 Marrakech, Morocco: Bridging the Gap between Cultures.

- Bennett, R., Rajabifard, A., Williamson, I. and Wallace, J. 2011. On the need for national land administration infrastructures. *Land use policy*, 29(1), 208-219.
- Bennett, R., Rajabifard, A., Williamson, I., Wallace, J. and Marwick, B., 2011. A National Vision for Australian Land Registries. *FIG Working Week 2011*, May 18-21 2011 Marrakech, Morocco: Bridging the Gap between Cultures.
- Potts, K., Bennett, R., Rajabifard, A. and Williamson, I., 2011. Spatially enabling risk for management of land and property. *Surveying & Spatial Sciences Biennial Conference 2011*, Wellington, New Zealand.
- Potts, K., Bennett, R. and Rajabifard, A. 2011. Spatially enabled bushfire recovery. *GeoJournal*, DOI: 10.1007/s10708-011-9437-3.
- Tambuwala, N., Bennett, R., Rajabifard, A., Wallace, J. and Williamson, I. 2011. On the role of government land information in macroeconomic policies. *Journal of Environment and Planning: Government Policy*, 29(6), 1087-1101.
- Tambuwala, N., Bennett, R., Rajabifard, A. and Williamson, I., 2011. Understanding the relationship between spatial information, property markets and macroeconomic policy. *Spatial Sciences & Surveying Biennial Conference 2011*. Wellington, New Zealand.
- Williamson, I., Bennett, R., Rajabifard, A. and Wallace, J., 2011. Lessons for Federal Countries that have State Land Registries- The Australian Experience. *The 11th South East Asian Surveyors Conference (SEASC)*. Kuala Lumpur, Malaysia.
- Williamson, I., Rajabifard, A., Wallace, J. and Bennett, R., 2011. A Spatially Enabled Society. ed. *FIG Working Week 2011*, May 18-21 2011 Marrakech, Morocco: Bridging the Gap between Cultures.

7.3 Land and Property Management/3D Cadastre (ARC-Linkage) 2012–2015

Staff: Abbas Rajabifard, Ian Williamson, Tuan Ngo, Mohsen Kalantari, Ida Jazayeri, Brian Marwick

Students: Ali Aien, Davood Shojaei, Serene Ho, Sam Amirebrahimi

Senior Advisor: Brian Marwick, Ian Bishop

Industry Partners: Land Victoria, Land and Property Information (NSW), PSMA Australia Ltd., Intergovernmental Committee on Surveying and mapping (ICSM), VEKTA Australia, Alexander Symonds Pty Ltd, Fender Katsalidis Architects, Owners Corporation Victoria.

Status: In progress

This project develops an infrastructure which helps address the problem of modelling and managing complex 3-dimensional (3D) property rights, restrictions and responsibilities in multi-level developments in growing cities. The project receives strong contributions from public and private sector partners as there is no innovative solution worldwide. 2D survey plans restrict the ability of architects, engineers, developers and governments to better utilize 3D spaces. They lack 3D registration and representation tools and result in slow planning, increased construction costs and complex management of multi-level developments. The project reports on the technical, legal and institutional components required to build 3D property information systems.

This project aims to deliver:

- An improved understanding of the problems and issues associated with incorporating 3D property information into land administration systems
- A specification of the technical, policy, legal and institutional aspects of a 3D property information and representation system
- A 3D data model and database management system
- A 3D representation and registration model
- A prototype 3D property information and building representation system.



Publications

A total number of 8 publications have arisen from this project between 2011–2012.

- Aien, A., Kalantari, M., Rajabifard, A., Williamson, I. and Shojaei, D., 2012. Developing and Testing a 3D Cadastral Data Model- A Case Study in Australia. *XXII International Society for Photogrammetry & Remote Sensing Congress*, 25 Aug - 1 Sep 2012 Melbourne, Australia: ISPRS Annals of Photogrammetry, Remote Sensing and the Spatial Information Sciences, 1-6.
- Amirebrahimi, S. and Rajabifard, A., 2012. An Integrated Web-based 3D Modeling and Visualization Platform to Support Sustainable Cities. *XXII International Society for Photogrammetry & Remote Sensing Congress*, 25 Aug -1 Sep 2012 Melbourne, Australia: ISPRS Annals of Photogrammetry, Remote Sensing and the Spatial Information Sciences, 299-304.
- Ho, S. and Rajabifard, A., 2012. 3D Land and Property Information System: A Multi-level Infrastructure for Sustainable Urbanisation and a Spatially Enabled Society. *In: Coleman, D. and Rajabifard, A. eds. Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*. GSDI Association Press.
- Rajabifard, A., Kalantari, M., Williamson, I., (2012); Land and Property Information in 3D, FIG Working Week 2012, 6-10 May 2012, Rome, Italy.
- Shojaei, D., Rajabifard, A., Kalantari, M., Bishop, I., and Aien, A., (2012); 3D Visualization System for Cadastres, The XXII International Society for Photogrammetry & Remote Sensing Congress. Melbourne, Australia (Abstract Submitted).
- Aien, A., Rajabifard, A., Kalantari, M. and Williamson, I., 2011. Aspects of 3D Cadastre- A Case Study in Victoria. *FIG Working Week 2011*. Marrakech, Morocco.
- Aien, A., Kalantari, M., Rajabifard, A., Williamson, I. and Bennett, R., 2011. Principles of 3D Cadastral Data Modelling. *2nd International Workshop on 3D Cadastres organized by FIG, EuroSDR and TU Delft*. Delft, The Netherlands.
- Aien, A., Rajabifard, A., Kalantari, M., Williamson, I. and Shojaei, D., 2011. 3D Cadastre in Victoria. *GIM International Magazine*.

7.4 The Australian Urban Research Infrastructure Network (AURIN), & Australian National Data Service (ANDS) and Data Integration and Demonstrator project (2012–2013)

The purpose of this project is to facilitate access to data sets for the Melbourne North West corridor and in turn provide researchers, policy makers, planners and practitioners with access to the data via the AURIN portal. Such unprecedented data access will enable world-class research that will be focused toward addressing the key policy issues in the North West region of Melbourne, as identified by the North and West Metropolitan Regional Management Forum. The project is to be conducted through the Centre for Spatial Data Infrastructure and Land Administration (CSDILA) at the University of Melbourne and involves three faculties across the University of Melbourne. The aim of the project is to demonstrate the benefit of providing open access of government datasets to researchers, planners and policy makers in dealing with problems of space, place, and liveability. The value of the project will be established through four demonstrator projects which cover four of the most pressing issues facing the North West Melbourne Region they are: Walkability, Employment Clustering, Housing Affordability and Health services.

8 Visiting Program and other official visitors

The Visiting Program was a successful component of the Centre for 2011 and 2012. Through the support of The University of Melbourne, the Centre hosted the visits from the following researchers and scholars. These visits were mutually beneficial to the research of the Centre and to research partners. In addition, due to the ISPRS Congress held in Melbourne the Centre received visits by delegates from: US, Canada, India, Japan, Poland, South Africa, Malaysia, Iran and Germany.

Prof. David J. Cowen, Department of Geography, University of South Carolina

The Honourable Mathew Guy, Minister of Planning, Victoria, Australia

Drew Clarke PSM, Secretary of the Commonwealth Department of Resources, Energy and Tourism

Professor Ayman Habib Head of the Department of Geomatics Engineering at the University of Calgary, Canada

Dr Daniel Paez, Transport planner, Colombia

Dr. Abolghasem Sadeghi-Niaraki, Department of Geoinformatic Eng., INHA University South Korea (Engineering Award)

Mr. Patrick Meehan, Director of Land Surveying for East Coast operations, VEKTA, Victoria, Australia

Mr. Jim Curnow and Mr. Michael Burdett, Manager Directors of Alexander Symonds, SA, Australia

Professor Stéphane Roche, Department of Geomatics Sciences, Université Laval, Québec, Canada

Mr. Eric Mwaikambo, A PhD candidate from Ardhi University, Tanzania

Mr. Majid Kiavarz, A PhD candidate from Tehran University, Iran

Mr. Sudarshan Ramachandran, VPAC, Victoria, Australia

Dr. Richard Simpson, nextspace, New Zealand

Mr. Kevin Tasker, Mr. John Taylor, Mr. Dionnald Beh Boonheng, Bentley Systems

Mr. Mohammad Reza Namazi Rad, SMART Infrastructure Facility, University of Wollongong

Associate Professor Kevin McDougall, Associate Dean of Faculty of Engineering and Surveying, The University of Southern Queensland

Ms. Liz Marchant, Executive Director in the ANZLIC National Office

Associate Professor Temenoujka Bandrova, University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria

Prof. Dr. Milan Konecny, Masaryk University, Czech Republic, past-president of ICA, and vice-president of International Society for Digital Earth

Land Administration and Development undergraduate and postgraduate students UNIVERSITI TEKNOLOGI MALAYSIA (UTM)

9 Contribution to seminars, conferences and meetings

Members of the Centre have also contributed to seminars and conferences by attending, presenting, participating in and representing the Centre's research program achievements.

Event	Date	Place	Contribution
11 th South East Asian Survey Congress	June 2011	Malaysia	Keynote speaker
UNGGIM First High Level Forum	September 2011	South Korea	Member of Stream Committee
4 th UN Land Administration Forum	October 2011	Australia	Workshop organisation
Surveying and Spatial Sciences Conference 2011	November 2011	New Zealand	Speaker and Paper presentation
Eye on Earth Summit – UNEP	December 2011	UAE	Framework Committee Member
2 nd International Workshop on 3D Cadastres	November 2011	Netherlands	Paper presentation
FIG Working Week	May 2012	Italy	Paper presentation
GSDI 13 World Conference – Spatially Enabling Government, Industry and Citizens	May 2012	Canada	Conference Chair, Keynote Speaker and Paper presentations
ISPRS Congress	August 2012	Australia	Chair Special Session. Speaker and Paper presentations
SSSI: NSW/ACT Metadata And Spatial Data	August 2012	Australia	Project presentation

10 Contribution to Professional and Scientific Associations and Societies

In the last year the Centre has extensively contributed to professional and scientific associations both national and internationally.

Presidency of GSDI by Professor Rajabifard

Honorary Fellow -Surveying and Spatial Science Institute (SSSI)

Member - Spatial Data Standards Commission-International Cartography Association

Member - Victorian Spatial Council

Member Editorial Board, Spatial Science Journal

Editor - GSDI- Asia-Pacific Newsletter

Scientific Member, GSDI Conferences

Advisory Member Coordinates Professional magazine

Member , Standard Australia , ISO Metadata

11 Highlights of the Centre 2011

Successful ARC-Linkage application on Land and Property Information in 3D

This project aims to develop a three dimensional (3D) cadastre - an infrastructure for managing and modelling complex property rights, restrictions and responsibilities. This new land and property inventory will address the problem facing two dimensional (2D) cadastres: managing the thousands of layered property interests embedded within modern cities and sensitive natural environments by developing a 3D visualisation and registration platform. The partners and collaborating organisations on this project are Vekta Pty Ltd, Alexander Symonds, Department of Sustainability and Environment VIC, Fender Katsalidis Architects, the Intergovernmental Committee On Surveying & Mapping, Land and Property Information NSW, Owners Corporation Victoria and PSMA Australia Ltd.

Successful completion of ARC Linkage Project on Automating and Integrating Spatial Data and Metadata Process

This ARC-Linkage project investigated the importance of having an integrated system for both spatial data and metadata information in which that metadata and spatial data can be integrated within the one spatial dataset, so that when spatial data is updated, metadata related to that data is also automatically updated.

Successful bid on the development of the Australian Urban Research Infrastructure Network (AURIN) Metadata Tool

The aim of the project is to customize GeoNetwork for the AURIN Portal to enable the AURIN portal users to search and discover data and services, data custodians and/or creators to create and edit associated metadata, and AURIN administrators to control, edit, and augment the metadata records.

Fourth UN-sponsored Land Administration Forum for the Asia Pacific Region "Beyond Spatial Enablement" and ten-year anniversary celebration of CSDILA

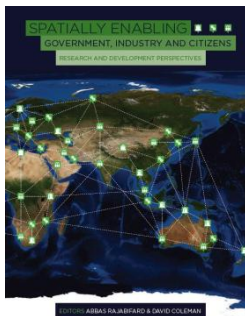
These events, held concurrently, were a major success with the attendance of many eminent international figures from the surveying and spatial sciences industries, who shared their expertise to contribute to the outcomes of the event. The forum concluded with the ten-year anniversary celebrations of the Centre.

12 Publications in 2011-2012

The Centre has published 42 publications as follows:

Year	Book	Book Chapter	Journal Paper	Conference Paper	Professional Magazine	Total
2011–2012	1	9	11	20	1	42

12.1 Books/Book Chapters



Rajabifard, A. and Coleman, D., (2012) *Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*, ISBN: 978-0-9852444-0-8, GSDI Association Press

- Bennett, R., *et al.*, 2012. Using digital globes to visualize climate change impact. *In: Shi, W., et al.* eds. *ISPRS Book Series*. CRC Press.
- Ho, S. and Rajabifard, A., 2012. 3D Land and Property Information System: A Multi-level Infrastructure for Sustainable Urbanisation and a Spatially Enabled Society. *In: Coleman, D. and Rajabifard, A.* eds. *Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*. GSDI Association Press.
- Potts, K., Rajabifard, A., Bennett, R. and Williamson, I., 2012. Spatially Enabled Risk Management: Models, Cases, Validation. *In: Coleman, D. and Rajabifard, A.* eds. *Spatially Enabling Government, Industry and Citizens: Research and Development Perspectives*. GSDI Association Press.
- Rajabifard, A., 2012. Spatial data infrastructure. *In: Steudler, D. and Rajabifard, A.* eds. *Spatially enabled society*. Denmark: International Federation of Surveyors, 37-43.
- Rajabifard, A., Ho, S. and Wallace, J., 2012. Legal framework. *In: Steudler, D. and Rajabifard, A.* eds. *Spatially enabled society*. Denmark: International Federation of Surveyors, 19-23.
- Steudler, D. and Rajabifard, A., eds., 2012. *Spatially enabled society*. Denmark: International Federation of Surveyors.
- Steudler, D. and Rajabifard, A., 2012. Key elements for a spatially enabled society. *In: Steudler, D. and Rajabifard, A.* eds. *Spatially enabled society*. Denmark: International Federation of Surveyors, 17-19.
- Steudler, D. and Rajabifard, A., 2012. The role of land administration, land management and land governance in spatially enabled societies. *In: Steudler, D. and Rajabifard, A.* eds. *Spatially enabled society*. Denmark: International Federation of Surveyors, 13-16.
- Steudler, D. and Rajabifard, A., 2012. Spatial needs of societies. *In: Steudler, D. and Rajabifard, A.* eds. *Spatially enabled society*. Denmark: International Federation of Surveyors, 10-12.

12.2 Journal papers

- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J. 2013. On recognizing land administration as critical, public good infrastructure. *Land use policy*. Vol. 30 (1), pp. 84-93
- Bennett, R., Tambuwala, N., Rajabifard, A., Williamson, I. and Wallace, J. 2012. On recognizing land administration as critical, public good infrastructure. *Land use policy*, 30(1), 84-93.
- Bennett, R., Rajabifard, A., Williamson, I. and Wallace, J. 2011. On the need for national land administration infrastructures. *Land use policy*, 29(1), 208-219.

- Grus, g., *et al.* 2011. An assessment view to evaluate whether Spatial Data Infrastructures meet their goals. *Computers, Environment and Urban Systems*, 35(3), 217-229.
- Olfat, H., Kalantari, M., Rajabifard, A., Williamson, I. P. and Senot, H. 2012. Spatial Metadata Automation: A Key to Spatially Enabling Platform. *International Journal of Spatial Data Infrastructures Research*, 7, 173-195.
- Olfat, H., Kalantari, M., Rajabifard, A., Senot, H. and Williamson, I. P. 2012. A GML-based Approach to Automate Spatial Metadata Updating. *International Journal of GIS*, DOI:10.1080/13658816.2012.678853.
- Olfat, H., Kalantari, M., Rajabifard, A. and Williamson, I. 2012. Towards a Foundation for Spatial Metadata Automation. *Journal of Spatial Science*, 57(1), 65-81.
- Potts, K., Bennett, R. and Rajabifard, A. 2011. Spatially enabled bushfire recovery. *GeoJournal*, DOI: 10.1007/s10708-011-9437-3.
- Tambuwalla, N., Bennett, R., Rajabifard, A., Wallace, J. and Williamson, I. 2011. On the role of government land information in macroeconomic policies. *Journal of Environment and Planning: Government Policy*, 29(6), 1087-1101.
- Tambuwalla, N., Rajabifard, A., Bennett, R., Wallace, J. and Williamson, I. 2012. Inter-governmental land information asymmetries in Australia. *Journal of Spatial Sciences*, 57(1), 83-100.
- Vaez, S. and Rajabifard, A. 2012. Seamless SDI Design by Using UML Modeling. *International Journal of Spatial Data Infrastructures Research*, 7, 207-224.

12.3 Conference Papers

- Agunbiade, M., Rajabifard, A. and Bennett, R., Land Administration for Housing Production: Drivers, Concepts, and Analytical Tools. *FIG Working Week 2011*, 2011 Marrakech, Morocco: Bridging the Gap between Cultures.
- Aien, A., Kalantari, M., Rajabifard, A., Williamson, I. and Bennett, R., 2011. Principles of 3D Cadastral Data Modelling. *2nd International Workshop on 3D Cadastres organized by FIG, EuroSDR and TU Delft*. Delft, The Netherlands.
- Aien, A., Kalantari, M., Rajabifard, A., Williamson, I. and Shojaei, D., 2012. Developing and Testing a 3D Cadastral Data Model- A Case Study in Australia. *XXII International Society for Photogrammetry & Remote Sensing Congress*, 25 Aug - 1 Sep 2012 Melbourne, Australia: ISPRS Annals of Photogrammetry, Remote Sensing and the Spatial Information Sciences, 1-6.
- Aien, A., Rajabifard, A., Kalantari, M. and Williamson, I., 2011. Aspects of 3D Cadastre- A Case Study in Victoria. *FIG Working Week 2011*. Marrakech, Morocco.
- Amirebrahimi, S. and Rajabifard, A., 2012. An Integrated Web-based 3D Modeling and Visualization Platform to Support Sustainable Cities. *XXII International Society for Photogrammetry & Remote Sensing Congress*, 25 Aug -1 Sep 2012 Melbourne, Australia: ISPRS Annals of Photogrammetry, Remote Sensing and the Spatial Information Sciences, 299-304.
- Bennett, R., Rajabifard, A., Williamson, I. and Wallace, J., 2012. Nations Need National Land Administration Infrastructures. *FIG Working Week 2012*, Rome, Italy: Knowing how to manage the territory, protect the environment, evaluate the cultural heritage.
- Bennett, R., Rajabifard, A., Williamson, I., Wallace, J. and Marwick, B., 2011. A National Vision for Australian Land Registries. *FIG Working Week 2011*, May 18-21 2011 Marrakech, Morocco: Bridging the Gap between Cultures.
- Bennett, R., Tambuwalla, N., Rajabifard, A., Williamson, I. and Wallace, J., 2012. Contemporary Land Administration: The Importance of Being Infrastructure. *FIG Working Week 2012*, 2012 Rome, Italy: Knowing to manage the territory, protect the environment, evaluate the cultural heritage.
- Marwick, B., Rajabifard, A., Williamson, I. and Kalantari, M., 2012. National Land Information Infrastructure through a Collaborative Framework. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy: Knowing to manage the territory, protect the environment, evaluate the cultural heritage.
- Potts, K., Bennett, R., Rajabifard, A. and Williamson, I., 2011. Spatially enabling risk for management of land and property. *Surveying & Spatial Sciences Biennial Conference 2011*, Wellington, New Zealand.
- Rajabifard, A., Kalantari, M. and Williamson, I., 2012. Land and Property Information in 3D. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy: Knowing how to manage the territory, protect the environment, evaluate the cultural heritage.
- Reisi, M., Aye, L., Rajabifard, A. and Ngo, T., 2012. Urban Structure and Transport- Melbourne Case Study. *11th International Conference on Traffic and Transportation Engineering*. Tehran, Iran.

- Shojaei, D., Rajabifard, A., Kalantari, M., Bishop, I., and Aien, A., (2012); 3D Visualization System for Cadastres, The XXII International Society for Photogrammetry & Remote Sensing Congress. Melbourne, Australia (Abstract Submitted).
- Sutanta, H., Rajabifard, A. and Bishop, I., 2011. Implementation of acceptable risk measures in planning support system for reducing disaster risk in a coastal urban city. *World Delta Summit 2011*. Jakarta, Indonesia.
- Tambuwala, N., Bennett, R., Rajabifard, A. and Williamson, I., 2011. Understanding the relationship between spatial information, property markets and macroeconomic policy. *Spatial Sciences & Surveying Biennial Conference 2011*. Wellington, New Zealand.
- Tambuwala, N., Rajabifard, A., Bennett, R., Wallace, J. and Williamson, I., 2012. Authoritative land information and Australian property markets. *FIG Working Week 2012*, 6-10 May 2012 Rome, Italy.
- Williamson, I., Bennett, R., Rajabifard, A. and Wallace, J., 2011. Lessons for Federal Countries that have State Land Registries- The Australian Experience. *The 11th South East Asian Surveyors Conference (SEASC)*. Kuala Lumpur, Malaysia.
- Williamson, I., Rajabifard, A., Wallace, J. and Bennett, R., 2011. A Spatially Enabled Society. ed. *FIG Working Week 2011*, May 18-21 2011 Marrakech, Morocco: Bridging the Gap between Cultures.
- Winter, S., *et al.*, 2011. Starting to Talk about Place. ed. *SURVEYING & SPATIAL SCIENCES BIENNIAL CONFERENCE 2011*, 63-73.
- Winter, S., *et al.*, 2011. Location-Based Mobile Games for Spatial Knowledge Acquisition. *Workshop on Cognitive Engineering for Mobile GIS*, 1-8.

12.4 Professional Magazines

- Aien, A., Rajabifard, A., Kalantari, M., Williamson, I. and Shojaei, D., 2011. 3D Cadastre in Victoria. *GIM International Magazine*.

12.5 Spatial Data Infrastructure – Asia Pacific News Items

- Agunbiade, M. (2010). Land Administration for Housing Production in the context of SDI. *Spatial Data Infrastructure Asia and the Pacific Newsletter*, 7, 3-4.
- Tambuwala, N. (2010). A national property information infrastructure for managing land and land related markets. *SDI-Asia/Pacific Newsletter*, 7/11, 4-5.

12.6 Global Spatial Data Infrastructure – Asia and the Pacific Monthly Newsletter

Available form <http://csdila.unimelb.edu.au/publication/newsletter.html>

13 Website

The website presents information about people, skill development program, publications, research project, news and events. The website can be accessed through <http://www.csdila.unimelb.edu.au/>.

WEB Statistics:

According to Google analytics between 2011 and 2012, there have been visits from more than 100 countries from around the world including Asia-Pacific, Australia, Europe, Africa, North America and Southern America.



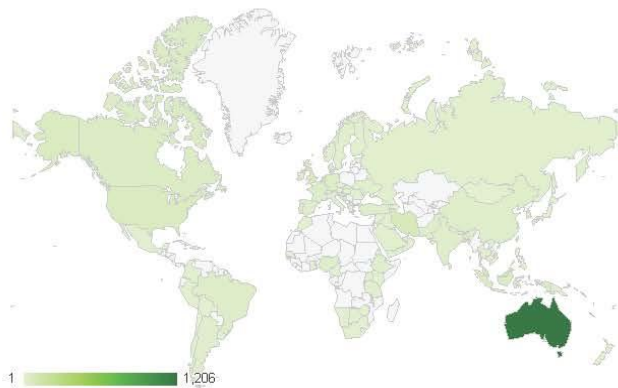
1,258 people visited this site

- Visits: **2,533**
- Unique Visitors: **1,258**
- Pageviews: **6,401**
- Pages / Visit: **2.53**
- Avg. Visit Duration: **00:03:46**
- Bounce Rate: **59.97%**
- % New Visits: **48.76%**



Country / Territory	Visits	% Visits
1. Australia	1,206	47.61%
2. Netherlands	111	4.38%
3. Malaysia	100	3.95%
4. Iran	84	3.32%
5. United Kingdom	71	2.80%
6. United States	62	2.45%
7. Portugal	55	2.17%
8. South Korea	53	2.09%
9. Indonesia	47	1.86%
10. Canada	46	1.82%

Site Usage



Visits 2,533 <small>% of Total: 100.00%(2,533)</small>	Pages / Visit 2.53 <small>Site Avg: 2.53 (0.00%)</small>	Avg. Visit Duration 00:03:46 <small>Site Avg: 00:03:46 (0.00%)</small>	% New Visits 48.76% <small>Site Avg: 48.76%(0.00%)</small>	Bounce Rate 59.97% <small>Site Avg: 59.97%(0.00%)</small>
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